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geographical changes of the earth's surface here set forth, is not the result of any preconceived theory, but has grown out of a careful study of the facts accumulated, and has led to a considerable modification of the author's previous views. It may be described as an application of the general theory of evolution, to solve the problem of the distribution of animals ; but it also furnishes some independent support to that theory, both by showing what a great variety of curious facts are explained by its means, and by answering some of the objections which have been founded on supposed difficulties in the distribution of animals in space and time.

It also illustrates and supports the geological doctrine of the general permanence of our great continents and oceans, by showing how many facts in the distribution of animals can only be explained and understood on such a supposition, and it exhibits in a striking manner the enormous influence of the Glacial epoch, in determining the existing zoölogical features of the various continents. And lastly, it furnishes a more consistent and intelligible idea than has yet been reached by any other mode of investigation of all the more important changes of the earth's surface that have probably occurred during the entire Tertiary period, and of the influence of these changes in bringing about the general features, as well as many of the more interesting details and puzzling anomalies of the geographical distribution of animals.

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#### RECENT LITERATURE.

MEMOIRS OF THE GEOLOGICAL SURVEY OF KENTUCKY.<sup>1</sup> — The first fruits of the reëstablished Geological Survey of Kentucky appear in a large and admirably illustrated volume of memoirs. Professor Shaler publishes papers on the antiquity of the caverns and on the fossil brachiopods of the Ohio Valley, and, in conjunction with Mr. Carr contributes the first of a series of papers on the prehistoric remains of Kentucky ; while Mr. Allen furnishes an elaborate memoir on the American bisons, living and extinct. The first of Professor Shaler's papers has already appeared in the memoirs of the Boston Natural History Society, and Mr. Allen's monograph is published simultaneously by the Museum of Comparative Zoölogy. The latter paper forms the bulk of the volume (246 pp.) and is illustrated by twelve plates, half of them double, and by a map of North America. It is one of the most com-

<sup>1</sup> *Memoirs of the Geological Survey of Kentucky.* N. S. SHALER, Director. Vol. I. Cambridge, 1876. 4to, pp. 360, 27 plates, 1 map.

plete monographs ever published in this country, and a notable contribution to American science. The author recognizes two species of fossil bisons in America, *B. latifrons* and *B. antiquus* and a single living species, *B. Americanus*, of which he considers *B. antiquus* the immediate progenitor. The systematic part of the work, including a full account of the variation and habits of the recent species, extends over seventy pages, and the plates are illustrative of this portion. The map accompanies the larger part of the work, which relates to the past and present geographical distribution of the American bison and presents an appalling picture of the reckless waste and rapidly diminishing numbers of this noble animal. By most painstaking research among historical works and systematic inquiry among living witnesses, he has established the boundaries of the range of the "buffalo" as it existed when the white man first landed in America and at successive epochs to the present time, when it has become separated into a northern and a southern herd occupying comparatively restricted areas. The details extend over one hundred pages, but in the first part of his work Mr. Allen gives a general summary, as follows :—

"The habitat of the bison formerly extended from Great Slave Lake on the north, in latitude about 62°, to the northwestern provinces of Mexico, as far south as latitude 25°. Its range in British North America extended from the Rocky Mountains on the west to the wooded highlands about six hundred miles west of Hudson's Bay, or about to a line running southeastward from the Great Slave Lake to the Lake of the Woods. Its range in the United States formerly embraced a considerable area west of the Rocky Mountains, its recent remains having been found in Oregon as far west as the Blue Mountains, and further south it occupied the Great Salt Lake Basin, extending westward even to the Sierra Nevada Mountains, while less than fifty years since it existed over the head waters of the Green and Grand rivers, and other sources of the Colorado. East of the Rocky Mountains its range extended southward far beyond the Rio Grande, and eastward throughout the region drained by the Ohio River and its tributaries. Its northern limit east of the Mississippi was the Great Lakes, along which it extended eastward to near the eastern end of Lake Erie. It appears not to have occurred south of the Tennessee River, and only to a limited extent east of the Alleghanies, chiefly in the upper districts of North and South Carolina."

"Its present range embraces two distinct and comparatively small areas. The southern is chiefly limited to Western Kansas, a part of the Indian Territory, and Northwestern Texas, — in all together embracing a region about equal in size to the present State of Kansas. The northern district extends from the sources of the principal southern tributaries of the Yellowstone northward into the British Possessions, embracing an area not much greater than the present Territory of Montana.

Over these regions, however, it is rapidly disappearing,<sup>1</sup> and at its present rate of decrease will certainly become wholly extinct during the next quarter of a century." (Pages 54-55.)

There can be no question that the present generation will see the utter extinction of the bison unless some means are speedily taken by the general government, or by the territories to which its range is now restricted, to protect it by the establishment and stringent enforcement of laws providing for close time and limited slaughter. One hundred thousand killed in four months around Fort Dodge; two hundred thousand in a single season in Kansas, merely for the hides; three thousand by one man in one winter, — such are the statistics to which our attention is called.

Mr. Allen also gives a chapter on the products of the bison, the chase, and the possibilities of domestication; and Professor Shaler adds an interesting note on its age in the Ohio Valley, where he judges that the animal made its advent very recently, principally because its bones occur at Big Bone Lick only in the more superficial strata, where they are exceedingly abundant.

Professor Shaler's paper on the brachiopods is the first of a series, and treats of but a few species; these, however, are described with the greatest minuteness and care and very richly illustrated by heliotypes. In their joint essay on prehistoric remains, Messrs. Shaler and Carr discuss implements only, leaving other subjects for future treatment. All of the objects they describe and figure are "surface finds," and they profess to make no attempt to assign any of the specimens that have come within their observation to any particular period of time or phase of civilization. The introductory remarks on the mode of manufacturing stone implements by savage races and the chapters on the source of distribution of the stone implements of Kentucky, and on their antiquity, will be found very interesting.

HAECKEL'S HISTORY OF CREATION.<sup>2</sup> — Had Mr. Darwin when he first conceived the idea of natural selection, on his return from the voyage of the *Beagle*, had this book of Haeckel's thrust into his hands, he might then have stood aghast at the lengths to which the audacious German author goes. Here is a genealogical table of the entire organic world — the work of how many coming centuries we dare not predict — anticipated and set down in actual tables with all the assurance and confidence of an old-time prophet. The missing links even are all christened and diagnosed, from those which he thinks connected man with the

<sup>1</sup> If Colonel Dodge's statements in his recently published work, *The Hunting-Grounds of the Great West*, may be trusted, the range of the bison was already much restricted in 1876.

<sup>2</sup> *The History of Creation: or, the Development of the Earth and its Inhabitants by the Action of Natural Causes.* From the German of ERNST HAECKEL. The Translation revised by Prof. E. RAY LANKESTER. In 2 vols. New York: D. Appleton & Co. 1876. 12mo. \$5.00.